

Australian Dairy Industry

Represented by

Australian Dairy Farmers Ltd and

Dairy Australia

Response to

Agricultural Innovation Inquiry

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Contents

1. Summary	2
2. The Australian dairy industry.....	2
3. Improvements due to new technologies	3
<i>Impact of innovation</i>	3
<i>Recent technologies</i>	4
4. Emerging technologies.....	5
5. Barriers and challenges to innovation and adoption.....	6

About Australian Dairy Farmers Ltd

Australian Dairy Farmers (ADF) is the national advocacy body representing dairy farmers across the six dairying states. Our mission is to improve the profitability and sustainability of dairy farmers in Australia. ADF develops and co-ordinates policy and represents dairy farmers on national and international issues.

About Dairy Australia

Dairy Australia is the national services body for dairy farmers and the industry. Its role is to help farmers adapt to a changing operating environment, and achieve a profitable, sustainable dairy industry. As the industry's research and development corporation (RDC), it is the 'investment arm' of the industry, investing in projects that can't be done efficiently by individual farmers or companies.

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1. Summary

Research development and extension (RD&E) has provided the basis of significant productivity improvements over the last 20 years, at an annual average rate of 1.6 percent a year for dairy farms from 1978-79 to 2010-11. Independent experts have estimated that the overall economic benefit of RD&E expenditure in the dairy industry is in the range of 3.3-6 to 1.

Recent and emerging technologies are promising. However, continuing development of innovation and its adoption is essential to a sustainable and profitable Australian dairy industry. World leading R&D for innovation and high-quality extension that supports change on farm is central to productivity, increasing returns at the farm gate and securing a prosperous industry

Australian dairy operates in an open and highly competitive international market, so continuous productivity gains are critical to competitiveness. Dairy, like all agricultural sectors, needs to understand the key opportunities for production and productivity gains and work towards achieving those gains. In order to benefit from the potential that innovation offers to increase productivity and competitiveness, a partnership between industry and government must work to seize all opportunities to develop new technologies and enable their availability to farmers.

There are a range of barriers and risks in innovation and adoption, which if addressed, would improve the opportunities which innovation offers for the future of Australian agriculture. Barriers include issues related to technology, commercial arrangements, capability, investment (including by Government), and community engagement.

Overall, there is a need to have the right operating environment in place where a competitive dairy sector has the confidence to invest in, and adapt to, new technology at both individual farm and industry level. The Government has a critical role in partnering with agriculture to overcome barriers and advance the central role of innovation.

2. The Australian dairy industry

The dairy industry is one of Australia's major rural industries. Based on farm gate value of production, it is ranked third behind the beef and wheat industries. There are approximately 6,400, mostly family owned farms, producing approximately 9.7 billion litres of milk annually¹.

The dairy industry is Australia's largest value added food industry, contributing \$13 billion at wholesale to the economy. It is estimated that the dairy industry directly employs 43,000 Australians on farms and in factories, while more than 100,000 rely on dairy for their livelihood through related service industries. As a major regional employer, the industry adds value through the processing of milk to produce drinking milk, cheese, butter, cream, yoghurts, infant formulas and a range of specialty products. The estimated value of farm production is \$4 billion annually and total value added production (ex-factory) is \$13 billion.

The dairy industry is also one of Australia's leading agrifood industries in terms of adding value to Australia's primary produce. Much of this processing occurs in rural areas, thus generating significant employment and economic activity in country Australia.

The dairy industry exports approximately 45% of manufactured or further processed product, to over 100 countries and this makes Australia the seventh largest trader of dairy products on the world market.

Our export markets are concentrated in the Asia/East Asia regions, with Japan being our largest customer by value, followed by China, Singapore, Malaysia, and Indonesia. In terms of our major export products, they are, cheese, milk powders (includes infant formula), butter, milk, and other dairy ingredients such as casein and whey products.

Our industry has the potential to grow substantially over the next decade to meet growing domestic and international demand. But to realise this potential, and remain competitive in the international

¹ Dairy Australia *Australian Dairy Industry In Focus 2014*

dairy market, it will be critical to innovate and adapt to support industry growth, increase productivity and profitability, and retain competitiveness with our key global competitors. Australian government support for innovation uptake is critical in our dairy industry remaining competitive.

Both Dairy Australia and ADF support the rural research and development corporation (RDC) model. RDCs provide an effective model to direct funds towards projects that are industry driven and targeted at achieving real benefits for the dairy industry. Industry cooperative research centres such as the Dairy Futures CRC have also proven an effective model to drive collaborative innovation for dairy farm profitability.

3. Improvements due to new technologies

Impact of innovation

The Australian dairy industry has a long history of improvements in the efficiency of its agricultural practices due to the adoption of new technologies. The 2011 report commissioned by Dairy Australia and the (then) Victorian Department of Primary Industries *“The impact of innovation on the dairy industry over the last 30 years: Evaluating the contribution of industry and government investment in pre farm gate RD&E”*² provides a comprehensive assessment of the impact of innovation for dairy.

Key findings of this report were that major increases in on-farm production are estimated to have increased Victorian dairy farm profitability by around \$10 billion over the three decades from 1980 to 2010. Of this, nearly half can be attributed to on-farm innovation, which is estimated to have increased farmers’ profitability by around \$7.7 billion in net present value terms, whilst only costing approximately \$2.3 billion in net present value terms, representing an estimated cost: benefit ratio of \$3.30 economic benefit for each dollar invested in RD&E.

The recorded increases in productivity were largely driven by increased pasture production and utilisation, increased supplementary feeding, and more efficient cows, all of which have been – and remain – key areas of focus for the dairy industry’s RD&E program. For example, the report outlined that milk production in Victoria (which represents 63% of total national milk production) more than doubled despite cow numbers remaining the same and a 35% reduction in effective grazing area. Milk yield per cow almost doubled and production per hectare increased by 192%. This 2011 report reinforced the importance of RD&E investment, and noted that while much had already been achieved through dairy industry RD&E, there was still much more benefit to be derived from this research in years ahead. The report also found that improvements in innovation had broader community benefits, particularly in the areas of natural resource management and public health and nutrition.

At the industry level, total factor productivity for Australian dairy farms has increased at an annual average rate of 1.6 percent a year from 1978-79 to 2010-11. This compares favourably with broadacre agriculture (1.0 percent) and the beef industry (0.9 percent). While there are other factors at play, well targeted innovation and RD&E programs has provided the basis of much of this productivity improvement.

However, it is important to note that despite favourable productivity increases, in the last decade productivity growth has slowed and we have struggled to keep up with the productivity gains of our major international competitor New Zealand.

Scope for further improvements from technologies remains. As Australian dairy operates in an open and highly competitive international market, continuous productivity gains are critical to competitiveness.

² <http://www.dairyaustralia.com.au/~media/Documents/Industry%20overview/About%20the%20industry/Vic%20DPI%20-%20Mega%20evaluation%20report%20-%202011%20November%202011.pdf>

Recent technologies

Some of the more recent, newer technologies bringing demonstrated improvements or potential improvements to productivity in dairying are listed below:

Animal management

- Animal monitoring - Oestrus detection monitors, pedometers, rumination monitoring sensors, temperature recording devices, ruminal pH sensors, automated body condition assessment, daily body weight measurements
- Animal tracking - Cattle global positioning system, radio frequency identification device (RFID) and biometrics, animal positioning and activity (feeding behaviour, resting behaviour, etc.)
- Animal genetics – biosciences to improve the rate of genetic gain that utilises knowledge from entire DNA sequences, including improved prediction of genetic merit and routine use of genetic evaluation services.

Milk harvesting

- Robotics & automation - Automatic milking systems (e.g. Lely Astronaut, DeLaval VMS, Insentec Astrea, etc.), automatic milking rotary (AMR) (e.g. DeLaval), automatic milking arm (e.g. Scott Milktech), automatic cup removers, automatic teat spray systems
- In-line sensors - Milk meters, daily milk yield recording, milk component monitoring, milk conductivity indicators.

Case study: automatic milking systems

Much of the Australian dairy industry is pasture-based and the traditional automatic milking systems are single box 'robots' developed for the European market which has small herds that are often housed indoors. Any Australian automatic milking system must rely on voluntary movement of cows to and from the paddocks, and be able to handle large herds. There are currently 34 dairy farms in Australia using automatic milking system technologies, with 136 robots milking 9,250 cows producing in excess of 50 million litres of milk per annum.

When surveyed, farmers with automatic milking systems have identified the following key factors that contributed to their decision to adopt automatic milking systems:

- Fewer people required (which will help address the issues of inability to find labour in regional Australia)
- Sustainability of operation (environmentally and with regard to labour and lifestyle)
- Farm succession
- Appeal of technology
- More appealing to return to dairy industry or to remain in industry without having to milk cows
- Age, need to slow down and reduce physical labour
- Opportunity to increase milking frequency without increasing labour
- Capture efficiencies of inputs and scale of operation
- Perceived advantages in individual cow feeding (based on production level).

Automatic milking systems have been developed for dairy farms to reduce the human labour required for milk harvesting. In Australia, the challenge is to incorporate automatic milking into pasture-based production systems while maintaining production targets. Current research through the Future Dairy project³, funded in part by Dairy Australia, is examining the constraints to successful implementation of automatic milking systems into the Australian dairy industry.

³ Future Dairy is an R&D program with a focus on automatic milking systems, refer <http://www.futuredairy.com.au/>

Feed management

- Robotics & automation - Automatic calf feeding, autonomous feed out systems (e.g. Lely Vector automatic feeding system, DeLaval feed wagon), feed pusher for housed feeding systems, mobile barn cleaner
- Individualised / differential feeding systems.

Grazing & pasture management

- Robotics and automation - Automated irrigation systems, automated drafting (e.g. Grazeway system)
- Remote sensing of pasture yield monitoring and measurement – utilising drones, sensors (e.g. C-Dax Pasture Meter), satellites
- Remote sensing of soils and water - irrigation sensors, soil water monitoring, soil mapping
- Variable-rate application (VRA) of inputs - fertiliser application (e.g. GreenSeeker technology for nitrogen application), variable rate irrigation (VRI).

Case study: electronic pasture meters

Low cost production of home grown pastures and forage have underpinned the competitive advantage of Australian dairy farmers. Technologies that measure pastures and allocates feed based upon feed available, growth rate and pasture cover targets will assist in improving the utilisation of home grown pastures/forages.

Duncan Macdonald manages two 550 cow dairy farms at Yolla in north-west Tasmania. The farms are about 5 km apart and each have a 180 hectare milking platform that is a mix of dryland and irrigation. He measures the amount of pasture in each paddock on a regular basis with a C-Dax pasture meter. The C-Dax Pasture Meter has two rows of sensors that record the height of pasture 200 times a second as it is towed behind a farm bike. These measurements of height and density are used in a calibration to estimate pasture cover in kilograms of dry matter pasture per hectare. Duncan uses a consistent pattern of towing the device across each paddock so that he gets a representative sample of the pasture cover in the particular paddock and can compare estimates from one week to the next. When he first bought the C-Dax Pasture Meter, Duncan spent considerable time developing his own calibrations for the two farms, and related the measurements to rising plate measurements that he had previously taken. Using the C-Dax Pasture Meter to measure pasture mass of each paddock takes Duncan about 1.5 hours on each farm. If he was using a rising plate meter it would take almost a full day.

4. Emerging technologies

Dairying is entering a new phase of technological change, including developments in digital technologies and lower cost sensors, robotics and autonomous vehicles. There are a large number of emerging technologies relevant to the dairy sector, across many different aspects of dairy farm operations and management used to improve measurement, monitoring, labour efficiency and/or management functions, to ultimately improve decision-making and farm performance.

As for existing technologies, emerging technologies will contribute additional data generation. 'Big data' creates enormous potential to take farm productivity to new levels but also poses challenges in translating increasing amounts of data into practical farm management and decision-making tools. Commercial solutions to resolve data integration and standardisation, and the provision of real-time "dashboards" are required to unlock the value of this data. Aspects of new and emerging advanced management technologies that may be of value to the dairy industry are listed below.

Animal management

- Animal health monitoring including infrared udder surface temperatures, respiration rates, reticular contractions, etc.

Milk harvesting

- In-line sensing of additional individual milk components, progesterone, high throughput MIR technology.

Grazing & pasture management

- Virtual fencing which uses wireless technologies, coordinates and sensors to control animal movements, including where they can graze
- Individual cow pasture intake technologies, measuring jaw movements
- Pasture quality monitoring and measurement
- New generation of low-cost sensors, e.g. soil acidity
- Autonomous vehicles, including small autonomous robots ('swarms') to scout paddocks continuously and identify and manage weed, pest and disease problems (for example, currently under development are robots to collect eggs in free range egg farms)
- Improved use and analysis of spatial data
- Plant genomics – biosciences to improve the yield and nutritive value of pastures including hybrid breeding, genomics assisted breeding (including GMO – genetically modified organisms), gene editing and novel endophytes to select and breed for specific traits.

5. Barriers and challenges to innovation and adoption

As mentioned above, the Australian dairy industry's competitive advantage lies in its management of an efficient pasture based grazing system. Over the last two decades, supplementary grain feeding has led to increased production and marginal productivity gains. Some of the biggest prospective productivity gains and opportunity to produce milk more cost-competitively lie in the development and application of new technology or innovation which increases the ability of the dairy farm's own capacity to produce and use feed for the cows to consume.

Any new tools and technologies must be explored and developed. It is then a farmer's choice whether to use those new tools and technologies.

We see a number of barriers and challenges in innovation and adoption of the next phase of technological change:

1. Commonwealth and State Governments' support for dairy RD&E is essential to addressing significant market failure issues and under-investment in innovation. There has been a decreasing relative and actual contribution from Commonwealth and State Governments to agricultural sector RD&E activity⁴. Ongoing funding and support for the RDC model at current value or increased levels is necessary or we face the risk that the dairy industry will not have sufficient capability to address industry challenges and opportunities through innovation. Effective RD&E and industry innovation must be a collaboration between the dairy industry, the Commonwealth Government and State Governments.
2. To invest in new technology and adapt farming practices to take up innovation, farmers need confidence, certainty and profitability. For example, the current market power imbalance in the domestic milk supply market has affected confidence and profitability of dairy farmers supplying that market. This impact has directly limited the ability of farmers to adopt new technology and innovation on farm. Competition law reforms, including reintroduction of an 'effects test' in the Act is a way that the Government can provide an improved legislative framework for

⁴ From the late 1970s, growth in public agricultural R&D expenditure slowed. The average annual growth rate declined from around 7% a year between 1952/53 and 1977/78, to around 0.6% a year from 1977/78 to 2006/07. Moreover, research intensity (defined as the ratio of public R&D expenditure to agricultural gross domestic product) peaked at over 5% in 1977/78, before declining to 3% in 2006/07 (OECD (2015), *Innovation, Agricultural Productivity and Sustainability in Australia*, OECD Food and Agricultural Reviews, OECD Publishing)

competition issues. As another example, successful free trade agreements negotiated by the Government can provide significant industry confidence to grow and invest at both farm and processor level.

3. The upfront capital cost for farmers to invest in new technology and innovation can be a barrier. A 2014 Dairy Australia study⁵ of energy technology opportunities for dairy farmers found that farmers are most likely to invest in projects with a payback period less than five years. Government led incentive programs that reduce the payback period can make the difference in a farmer's decision to invest in new technology or not.
4. Selecting appropriate technologies based on reasonable expectations of what value they can deliver can be difficult. Many advanced technologies are appearing on the market, sometimes prematurely with little or no validation under Australian field conditions or research results to underpin economic analysis.
5. Farmers need to deal with technology "lock-out" or inappropriate selection of proprietary systems that are not integrated with other systems. Commercial technology platforms are expensive to construct, maintain and enhance, and are dependent on reasonable scale or volume of use to drive down the cost per transaction or per user. Proprietary solutions are being developed that either lock farmers into their specific platform or attempt to link data from different devices and systems based on open protocols or standards.
6. A further challenge in this area is the integration of multiple technologies (often delivered by different companies) – for example, integrating automatic milking systems with remote pasture sensing and management.
7. Support and service for new technologies (after sales service) in regional areas can be limited, particularly while emerging technologies have low uptake. Service needs can be time critical in animal management and milk harvesting. Issues with capability or access to servicing can limit choice for farmers in technology decisions.
8. An area that is not currently adequately resourced is in developing learning and training initiatives for farmers and service providers in technology management and integration to ensure good farmer outcomes and minimise industry risks. This is beyond commercial training on specific products or after sales service. It involves building capability, particularly in technology assessment, integration and management in whole-farm-systems, through industry supported training, development of guidelines and resources and extension activities.
9. Delivery of extension services to farmers is changing. The dairy industry is facing a particular challenge due to the reduction in state government investment. There is no simple solution of a one off transition to private providers, as delivery of extension requires ongoing investment in public and private sector capability, particularly given the constant need to roll out new research, with an associated need to train providers. Effective extension requires Government, industry and service providers to collaborate to make the best possible use of the available funding and resources. Adoption will best be achieved through a combination of professional independent advice, training and education, technology support and financial incentives to support adoption.
10. New technologies involve dealing with terabytes of data generated each day and utilising increasing amounts of data as part of farm management decision-making. Data management at this level requires not only new skills and resources, but the development of effective, practical tools to enable farmers to take full advantage of any benefits this new "big data" environment can offer.
11. New technologies also mean increasing dependability on reliable cost-effective power supply and internet coverage which is a barrier in some regional areas. There are farms and regional dairy processing plants which cannot expand or develop new product lines due to limitations of the regional power supply. While the NBN is a welcome initiative, the time frame for access to reasonable internet speed is frustrating in many regional areas.

⁵ Dairy Australia, 2014. Reports relating to Direct Action Plan and the Emissions Reduction Fund available at <http://www.dairyaustralia.com.au/Environment-and-resources/Energy-costs-and-the-carbon-price.aspx>

12. New technologies must be commercialised to be available for farmers. There needs to be a market proposition for commercialisation and that will be managed in the market place. Government support is important in reducing any barriers that may impede commercialisation, for example unnecessary regulatory processes, inconsistent regulation across jurisdictions, or statutory bans not backed by scientific justification.
13. Consumer perception about new technologies or misunderstanding about the changing nature of farming is a potential barrier to growth and innovation. Government support could assist in public education and promotion of diverse farming systems which reflect market opportunities and the need to be globally competitive. 'Social licence' issues have the potential to damage the industry's reputation, and affect the confidence and willingness to invest in innovation. These issues have recently arisen in relation to the broad range of dairy production systems (from fully outdoor grazing systems with little grain supplement, right through to fully housed systems) and management practices. Social licence issues are also a risk to the application and use of breeding innovations such as GMO feeds (pastures, grains and other crop by-products). Our consumers are both domestic and global. Enabling government policy is critical to support the industry's social licence, and to work with processors and consumers to ensure farmers have access to the range of practices and technologies which will allow them to maintain a globally competitive dairy industry.